Issued Dec. 1, 1916.

U. S. DEPARTMENT OF AGRICULTURE.

BUREAU OF SOILS.

IMPORTANT SOILS

OF THE

UNITED STATES.

ISSUED TO ACCOMPANY A COLLECTION OF SOILS AND SUBSOILS (IN 13 BOXES) FOR USE OF SCHOOLS AND COLLEGES TEACHING AGRICULTURE AND PHYSICAL GEOGRAPHY.

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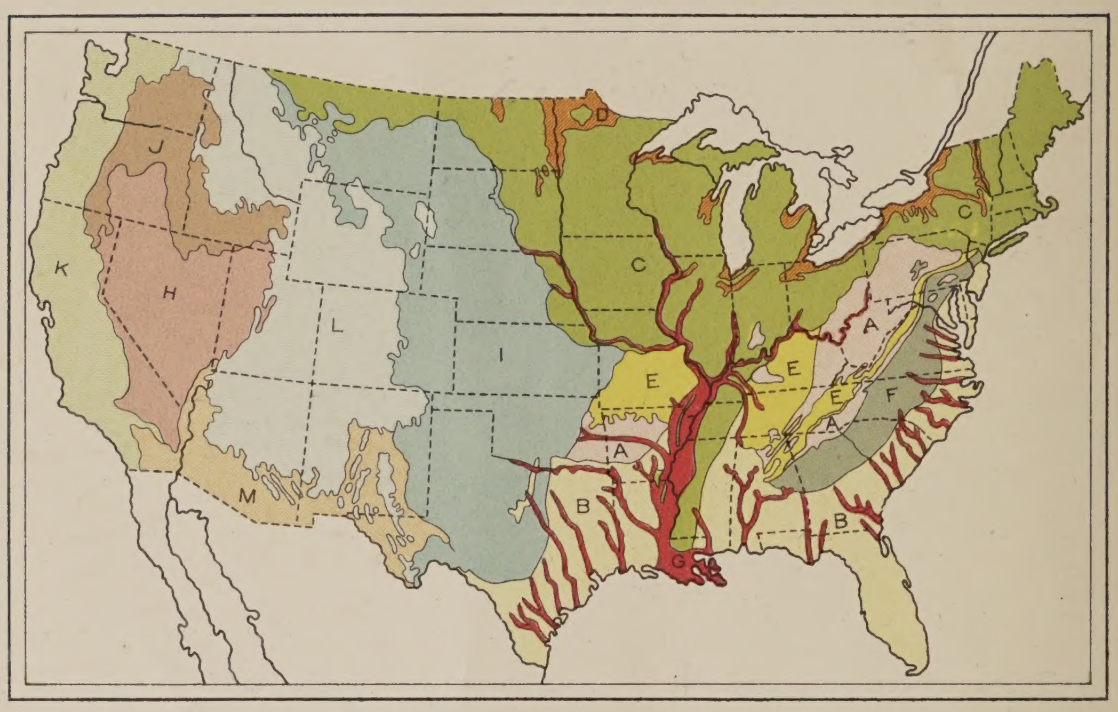
SOIL PROVINCES AND SOIL REGIONS

OF THE UNITED STATES



LEGEND

Soil Provinces

- A — Appalachian Mountain and Plateau
- B — Atlantic and Gulf Coastal Plain
- C — Glacial and Loessial
- D — Glacial Lake and River Terrace
- E — Limestone Valley and Upland
- F — Piedmont Plateau
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Soil Regions

- H — Great Basin
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IMPORTANT SOILS OF THE UNITED STATES.

The soils of the United States for purposes of classification are grouped into seven soil provinces, covering the eastern half of the United States, and six soil regions, covering the western half. The soil provinces differ in the petrographic and physical character of the rock from which the soil material was derived, topography, elevation, and in processes by which the soil material was accumulated. The soil regions do not conform to differences in the mode of origin or method of transportation of soil material, but to great physiographic regions, and the soils within each region differ in origin, these differences being substantially the same as the differences that distinguish the different soil provinces.

The soil provinces are substantially under humid conditions, and the soil regions are substantially under semiarid or arid climatic conditions.

The total land area covered by the eastern soil provinces amounts to 48.5 per cent, and of the western soil regions 51.5 per cent of the United States. The soil provinces include 85 per cent of the rural population, and the soil regions 15 per cent. The soil provinces carry 85 per cent of farm operators, with 59 operators for every 10,000 acres of total land area. The western soil regions have 15 per cent of the farm operators, and 10 operators per 10,000 acres of total land area. In the eastern soil provinces 40 per cent of the area is improved land in farms, amounting to 77 per cent of the improved land in farms in the United States. The western soil regions have 11.2 per cent of their area as improved land in farms, 23 per cent of the total improved land in farms in the United States.

THE SOIL PROVINCES OF THE UNITED STATES.

Glacial and Loessial Province.—The Glacial and Loessial Province covers an area in which the soil material has been moved to its present place in part by glaciers and in part by the wind (loess deposits). The material is heterogeneous in that it contains fragments of crystalline rocks, such as granite, gneiss, and diabase, as well as fragments of sedimentary rocks, such as sandstone, shale, and limestone, for the most part intermingled but locally with one or more of these classes of material absent.

Soils of this common origin occur north of the Missouri and Ohio Rivers with a narrow extension down the Mississippi to near its mouth, and cover a part of Pennsylvania and nearly all of New York and the New England States. North of an irregular line extending from Yankton, S. Dak., to Cincinnati, Ohio, the surface material is mainly glacial drift, but often locally modified by deposits of rushing glacial sheet waters and glacial rivers. South of this line the surface layer consists of stone-free and gravel-free silty material thought by many geologists to be of loessial origin, and is underlain by glacial débris except in the narrow southward extension along the Mississippi River.

West of central Ohio the surface is in general smoother than to the east, and across the southern part of the area the glacial deposits are thicker, as a rule, than are those in the hilly and mountainous country of New York, Pennsylvania, eastern Ohio, and New England. In the Lake Region, however, the deposits over large areas are apparently no thicker than in central New York and large areas in New England. The soils of the supposed loessial belt have generally a more uniform surface, as expressed in the term "plains."

The Glacial and Loessial Province covers about 20 per cent of the area of the United States. It carries about 33 per cent of the rural population of the United States, with 34.7 per cent of the farm operators, and has about 58 operators per 10,000 acres of total land area. About 52.9 per cent of the province is improved land in farms, and the province carries 42.4 per cent of the improved land in farms in the United States.

Two soils, the Carrington silt loam and the Miami clay loam, have been selected to represent the general characteristics of the soils of the glacial drift, and two others, the Marshall silt loam and the Knox silt loam, to represent the soils of loessial origin. The soil types comprised in the Carrington series cover 8.4 per cent of the province, the soils of the Miami series cover 14 per cent, those of the Marshall series 12.9, and of the Knox series 8.4 per cent. The soils selected to represent these series are dominant.

The Miami soils are similar in origin to the Carrington, both being glacial deposits, but they differ in color, owing to the high content of organic matter of the Carrington, which gives the soils of this series a very dark brown or black color as distinguished from the brown color of the Miami. Both have a yellowish-brown subsoil and are underlain by bowlder clay or other unweathered glacial débris. The Knox and Marshall soils are similar in origin, both being wind deposits, but the Knox is a brown soil, while the Marshall is very dark brown to black, owing to a much higher content of organic matter. Both have a yellowish-brown subsoil and are generally underlain at depths of 10 to 20 feet by bowlder clay or till. Organic

content determines the difference in color of these soils. It is low in the glacial soils of the Miami series and the wind deposited soils of the Knox series, and they are consequently light colored, while it is high in the ice-deposited soils of the Carrington series and the wind-deposited soils of the Marshall series, and accordingly they are dark colored. Both the black series are associated with original prairie conditions, an absence of trees and a prevalence of grasses, while both the light-colored series are associated with original timbered conditions.

The dark soils are used in the production of corn and hay, these products being sold or fed to hogs or beef and dairy cattle, under the type of agriculture that is found in the corn belt. North of the corn belt, however, where the season is too short for the ripening of commercial crops of corn, these black soils, particularly the Carrington, are used for the production of spring wheat. The Marshall soils are used for the production of corn to as full an extent as the Carrington.

The light-colored soils are used for the production of corn, hay, and winter wheat.

The Carrington soils for the most part lie within the area included between a line passing through central Kansas, Nebraska, and the Dakotas on the west, through western Indiana on the east, and central Missouri and Kansas on the south. On the north they extend across the international boundary line from North Dakota and western Minnesota.

The Marshall soils occur in western Iowa, eastern Nebraska, northeastern Kansas, and in Missouri in belts on both sides of the Missouri River, approximately parallel to but somewhat removed from that stream.

The Miami soils, in a general way, lie east of the Marshall and Carrington soils. They are associated with and are dominant factors in the type of general farming and dairying that prevails in the western half of Ohio, central and northern Indiana, southern Michigan, southern Wisconsin, and southeastern Minnesota.

The Knox soils in a general way occur in close association with the Marshall soils, but extend farther south along the Missouri and Mississippi Rivers. They are dominant in the type of farming where winter wheat is a major crop, occurring in southwestern Illinois, central Missouri, the extreme northeastern part of Kansas, and the eastern part of Nebraska.

Atlantic and Gulf Coastal Plain Province.—The Atlantic and Gulf Coastal Plain Province is a vast outwash plain and covers an area in which the soil material has been transported by rivers or flood waters from one or more of the older soil provinces, all classes of material being mixed according to the length and point of origin

of the river and its tributaries and the rate and volume of the flow from time to time. The coarser sands and gravels have for the most part been deposited in the river channel, while the medium and small-sized grains of sand, silt, and clay have been carried onward toward its entrance into the ocean. At this point, or during subsequent submergence of the coast, the ocean waves have pounded and agitated the material and the ocean currents have operated to cause a further separation of the sands, fine sands, silts, and clays, the finer material being carried into the deeper and quieter waters, and the coarser material left along the edge.

Soils of this common origin extend along the coast from New York City to the Mexican border, and cover from one-third to one-half of all the Atlantic Coast States, all of Florida, the greater part of Alabama and Mississippi, all the uplands of Louisiana, southern Arkansas, southeastern Oklahoma, and what is commonly known as east Texas and south Texas. The soil material comprised in this province is estimated to cover about 11.4 per cent of the United States.

The Atlantic and Gulf Coastal Plain Province carries about 19.6 per cent of the rural population of the United States, 19.9 per cent of the farm operators, and has about 58 operators per 10,000 acres of total land area. About 27.3 per cent of the province is improved land in farms, which amounts to about 12.5 per cent of the improved land in farms in the United States.

From the Potomac River northward the material carried into the sea came from the glaciated area of New York and northern Pennsylvania, from the Piedmont, the Limestone Valley, and the Appalachian regions, and was transported by the Hudson, Delaware, Susquehanna, and Potomac Rivers, and a great many smaller streams. Between the Potomac and the Roanoke it came from the Piedmont, Appalachian, and Limestone Valley regions. From the Roanoke to the Chattahoochee the material came from the crystalline rocks of the Piedmont only or from the east slope of the Blue Ridge, itself composed of such rocks. From the Alabama River to southern Louisiana the material has been derived from the rocks of the Mississippi basin, mainly sedimentary.

Six soils have been selected as the dominant soils of this province. The Norfolk soils cover about 32.7 per cent, the Orangeburg soils about 12 per cent, the Portsmouth soils about 6.2 per cent, the Houston soils about 6.2 per cent, the Sassafras soils about 3.7 per cent, and the Crowley soils about 1.1 per cent of the province. The types selected are the dominant types of each of these series.

The Norfolk soils are gray, with yellow subsoils. They are developed principally in that part of the Coastal Plain lying between the Potomac and Alabama Rivers, with a moderate development in

northeastern Texas. They are identified with a variety of agricultural interests, depending upon the texture of the soils and upon climatic conditions. The Norfolk fine sandy loam, represented in the accompanying collection of samples, is considered the dominant soil of the series, having a greater extent and a wider range of agricultural adaptation than any of the other types. It is one of the most important cotton soils of the South, it is the dominant corn soil of the Norfolk series, and is an important soil for the production of truck crops where yield rather than earliness of production is considered. In southern Virginia and North and South Carolina the deeper phases of this type are important in the production of bright tobacco. In southwestern Georgia and western Florida the fine sandy loam is the leading cigar-wrapper tobacco soil. This is the most extensively used soil for market peanuts, the industry centering in southeastern Virginia and northeastern North Carolina. Farther south it produces a cane sirup of good yield and bright color. The Norfolk sand and fine sand mature truck crops earlier and have this advantage over the fine sandy loam as special-purpose soils under intensive systems of agriculture. The Norfolk sand is peculiarly associated with the production of citrus fruit in Florida and of watermelons in Georgia, but both of these types are less well adapted to the staple farm crops than is the fine sandy loam. The Norfolk sandy loam is associated with about the same agricultural interests as the fine sandy loam, but because of its somewhat coarser texture has not quite the productive capacity of that type.

The Orangeburg soils are gray, with red subsoils. They occur in that portion of the Coastal Plain between South Carolina and the Alabama River and are quite extensively developed in eastern Mississippi, northern Louisiana, and in eastern Texas. In South Carolina and northern Georgia they occur generally west of the Norfolk belt, while in southern Georgia, Alabama, and Mississippi they flank the Norfolk belt on each side, extending down into western Florida. Type for type they are adapted to about the same range of agricultural use as the Norfolk soils, but are somewhat stronger and stand up better under average conditions of cultivation and use. They are peculiarly associated with the production of peaches in central Georgia and east Texas. In addition, in southwestern Georgia and western Florida they are associated with the production of cigar-wrapper tobacco, giving heavier yields but a leaf not so desirable in texture as that grown on the corresponding Norfolk types.

The Portsmouth soils are black, with light-gray or mottled yellow and gray subsoils, often with a wet, compact brown sand substratum that has the effect of a hardpan. These soils are found largely throughout the eastern part of the Coastal Plain from New York

City to Florida and throughout that State, occurring near the coast line or bordering the larger rivers or swamps. They generally need drainage for their highest development. They are rich in organic matter, and are associated with the production of corn, cabbage, and onions, and are peculiarly adapted to certain varieties of strawberries.

The Houston soils are dark-brown to black, with yellowish-brown to grayish subsoils. Unlike the other soils of the Coastal Plain, they are derived largely from marine calcareous sediments, the subsoil particularly being very calcareous. They occur in what is commonly known as the "black-prairie belt," extending from eastern Alabama through that State into northeastern Mississippi and in the "black waxy belt" of central Texas. These soils are excellent for growing cotton. They are also peculiarly adapted to the production of corn and forage crops and to alfalfa, and are therefore well suited to the raising and feeding of hogs and cattle.

The Sassafras soils are light brown, with reddish-yellow subsoils. They are found only in that part of the Coastal Plain between New York City and the Potomac River. They are associated with the type of agriculture that has long been prevalent in central and southern New Jersey, in Delaware, and on the eastern shores of Maryland, where wheat is a dominant crop, associated with corn and hay grasses, and where the feeding of cattle and the dairy interests have been of great importance. These soils have been dominant in the production of peaches and of vegetables for canning. In their adaptation to this form of general agriculture they are more like the Hagerstown soils of the Limestone Valley, the Chester soils of the Piedmont, and the Miami soils of the Glacial and Loessial Province than any other soils of the Coastal Plain.

The Crowley soils are gray, with mottled gray, yellow, and red subsoils. They occur only in that part of the Coastal Plain which has received material through the Mississippi drainage. They are peculiarly associated with the production of rice in southern Louisiana.

Appalachian Mountain and Plateau Province.—The Appalachian Mountain and Plateau Province covers an area in which the soil material has mainly been transported presumably by rivers no longer in existence, the material having subsequently been acted upon by ocean waves and currents, by which it was assorted into sands and clays during repeated submergences and later consolidated into sandstone and shale rocks. Since the final submergence the material has been pushed up to the relatively high altitude of the Appalachian Mountain Range and the high plateau to the west.

Soils of this common origin cover central and southwestern Pennsylvania, western Maryland, southeastern Ohio, most of West Vir-

ginia, and a small part of Virginia, South Carolina, North Carolina, Georgia, and Alabama, eastern Kentucky, and northern Arkansas, with small areas in southern Indiana and western Kentucky. This material covers about 4.5 per cent of the United States.

The Appalachian Mountain and Plateau Province carries about 11.4 per cent of the rural population of the United States and 9.3 per cent of the farm operators, giving 70 operators per 10,000 acres of total land area. About 34.7 per cent of the province is improved land in farms. This amounts to 6.2 per cent of the improved land in farms in the United States.

Two soils have been selected to represent this province, one from the Porters series which covers 9.6 per cent of the province, and the other from Dekalb series which covers 44 per cent.

The Porters series includes types with dark-red surface soils and red subsoils. They are derived from the crystalline rocks of the Blue Ridge Mountains and of the Ozark Mountains. On account of their generally steep and often rough topography they are very little used for agriculture, though producing excellent fruit, especially apples, at suitable elevations and with proper exposure. They are used also as cheap mountain pasture for the raising of young cattle.

The Dekalb soils are yellowish gray on the surface with a light-yellow subsoil. They are derived from the disintegration of sandstone and shale. Owing partly to their isolated position, partly to their rough topography, and partly to the character of the soil material they are not highly developed for agriculture. Locally they are of importance for the production of fruit, especially late varieties of peaches. They produce a considerable proportion of the commercial crops of buckwheat and rye. They furnish cheap pasture for young cattle and locally for sheep. Very little corn and wheat is produced on them. The principal agriculture in the region is carried on in the valleys either on soils derived from limestone or on soils belonging in the River Flood Plain Province.

River Flood Plain Province.—The River Flood Plain Province comprises an area in which the soil material has been and is being transported and laid down by running water mainly during floods. There is more or less intermingling of material during its transport, and there is a certain amount of segregation of material according to size, the coarser sand and gravel being deposited in or near the channel of the stream, the sandy loams, loams, and silt loams being spread out on its flood plains, and the finest clay segregated in swampy areas where the water is stagnant or flowing with low velocity. The River Flood Plain extends throughout all the soil provinces, the river channels reaching like fingers into the uplands. The river itself is far more extensive than the visible stream, extending, as it does, in the form of ground water at a moderate depth below the

surface throughout its drainage basin, the movement being extremely slow. Between the ground water and the surface the solvent action of meteoric waters on the soil material and the removal of dissolved mineral matter is quite important. During periods of heavy rains the sheet water covering the surface of the uplands is a visible extension of the river, and this acts in the transportation of material to the extent of excessive erosion at times in some places. Soils of the River Flood Plains Province occupy the flood plains and terraces along existing rivers and cover about 4 per cent of the area of the United States.

Owing to the manner of occurrence of the soils of this province, which are developed in narrow strips extending throughout the other soil provinces, they are farmed mainly in connection with the soils of the associated provinces, and no estimate of the rural population, farm operators, or improved land in farms can be given for this province separately.

Four soils have been selected to represent this province. Three of these, the Wabash, covering approximately 10.6 per cent of the province, the Huntington, covering about 6.2 per cent, and the Miller 3.1 per cent, are first-bottom soils, and one, the Cahaba, is a terrace soil, covering about 3.2 per cent of the province. Two classes of miscellaneous material, Muck and Peat, are also represented, the former covering approximately 4.6 per cent and the latter about 1.8 per cent of the province.

The Wabash soils are black with gray subsoils. They occur throughout the Glacial and Loessial Province, north of the Ohio River. They are first-bottom soils and generally in need of drainage. Where properly drained they are peculiarly adapted to corn and this is the chief crop, with the hay grasses as the next most important product.

The Huntington soils are brown with lighter brown subsoils. They occur throughout the Appalachian Mountain and Plateau and the Limestone Valley and Upland Provinces. They are first-bottom soils subject to overflow, and are generally in need of drainage. When properly drained and protected from overflow they are dominant in the agriculture of the region, particularly in the Appalachian Province. They are peculiarly adapted to corn and hay grasses.

The Miller soils are chocolate-red with chocolate-red subsoils. These soils are calcareous. They are first-bottom soils, although large areas are not subject to overflow. The material has been derived mainly, or to a considerable extent, from the Permian Red Beds of the residual prairie region and the soils are importantly developed along the Arkansas, Red, and Brazos Rivers in Texas and Louisiana. They are peculiarly adapted to cotton, corn, and alfalfa.

The Cahaba soils are brown with reddish-brown subsoils. They occur in the Coastal Plain Province, chiefly from South Carolina to central Mississippi. They consist mainly of Coastal Plain material with some Piedmont material. They are peculiarly adapted to cotton, and this is the dominant crop produced.

Muck is black and consists largely of vegetable matter which has accumulated through the growth and decay of rank vegetation under conditions of poor drainage. The amount of true soil material varies, the amount of organic matter ranging from about 20 per cent to 50 per cent or even as high as 85 per cent. The organic matter below the immediate surface generally has broken down, showing little or no fiber. The value of the Muck for agriculture varies widely with the character of the vegetation from which it is derived. Productive areas of Muck, where properly drained, are quite valuable, particularly for the growing of the heavier vegetables, such as cabbage, onions, and celery.

Peat is usually brown and fibrous, but sometimes occurs as black, nonfibrous material. The characteristic which distinguishes it from Muck is the small amount of mineral matter present, Peat being nearly a pure deposit of vegetable matter, the organic content ranging from 85 per cent to 93 per cent. The brown fibrous peat, unless it can be partially burned over and covered with the underlying sand, has proved to be one of the most difficult soil materials to grow commercial crops upon. The black nonfibrous peat approaches more nearly the agricultural value of muck.

Limestone Valley and Upland Province.—The Limestone Valley and Upland Province covers an area in which the soil material has been derived from limestone rocks, which were laid down under the ocean and contain slight admixtures of soil materials as impurities. With the gradual solution of the lime carbonate, these impurities have been left as the present soil material of the province.

Soils of this common origin occur mainly in a rather narrow valley lying between the Blue Ridge on the east and the Appalachian Mountains on the west and extending from eastern Pennsylvania to central Alabama, in the Central Basin of Tennessee and the Bluegrass Region of Kentucky and the contiguous highland region, over the greater part of Missouri south of the Missouri River, and in northern Arkansas. This province is estimated to cover 3.5 per cent of the United States.

The Limestone Valley and Upland Province carries approximately 8.6 per cent of the rural population of the United States, and 9 per cent of the farm operators, with 83 operators per 10,000 acres of total land area, and has 45.4 per cent of its area classed as improved land in farms, which is about 6.4 per cent of the total improved land in farms in the United States.

Two series have been selected as the dominant soils of this province—the Clarksville series, which covers about 55 per cent of the province, and the Hagerstown series, which covers about 28 per cent. The types selected are the dominant soils of these series.

The Clarksville soils are light gray, with yellow subsoils. They are developed principally in the southern part of the Great Valley, on the "Highland Rim" about the Central Basin and Bluegrass Region, and in the Missouri and Arkansas area, and constitute the upland limestone areas, as distinguished from the valleys occupied by the Hagerstown soils. A difference in topography is due to the more resistant nature of the limestone, which is frequently siliceous and includes interbedded chert rock, giving rise to the Clarksville, as compared with the purer limestone, giving rise to the Hagerstown soils. The Clarksville soils have an important place in the production of dark tobacco in Kentucky and Tennessee and locally in the production of strawberries, cantaloupes, and peaches. In Alabama and Georgia they are used for cotton and in the northern areas to some extent for general agriculture, with light yields of corn, wheat, and hay, large areas being still undeveloped or used for cheap pasture for the raising of cattle.

The Hagerstown soils are brown, with reddish-brown subsoils. They occur in the northern part of the Great Valley and in the Central Basin of Tennessee and the Bluegrass Region of Kentucky. They are dominant in the type of general farming which prevails in the Lancaster Valley of Pennsylvania, in the Frederick Valley of Maryland, in the Shenandoah Valley of Virginia, and in the Central Basin and Bluegrass Region, where wheat, corn, pasture grasses, particularly bluegrass, are important, and the fattening of cattle, the raising of horses, and the dairy industry are the principal animal industries. In Pennsylvania they are dominant in the production of cigar-filler tobacco and in central and northern Kentucky in the production of white Burley tobacco.

Piedmont Plateau Province.—The Piedmont Plateau Province covers an area in which the soil material has been derived from the disintegration in place of igneous and usually strongly crystalline rock such as granite, from highly metamorphosed rocks such as gneiss, from rather slightly metamorphosed rocks such as phyllites, and to a small extent from slightly or not at all metamorphosed rocks such as Triassic sandstone and shale.

Soils of this common origin lie in a belt between the Atlantic Coastal Plain and the Appalachian Mountains and Plateaus, extending from northern New Jersey to central Alabama, and averaging from 25 to 50 miles in width from its northern limits to central Virginia and about 100 miles in width southward. The soil material of this origin covers about 2.5 per cent of the area of the United States.

The Piedmont Plateau Province carries about 8 per cent of the rural population of the United States and about 7.9 per cent of the farm operators, giving 107 operators per 10,000 acres of total land area, with 45.1 per cent of the province classed as improved land in farms, which is about 4.4 per cent of the improved land in farms in the United States.

Three series have been selected as the dominant soils of this province, the Cecil series, covering about 60 per cent, the Chester series, about 6 per cent, and the Penn series, about 5.5 per cent of the province. The soil types selected to represent these series are dominant.

The Cecil clay is red, with a red subsoil. The Cecil sandy loam is gray, with a red subsoil. Both are derived typically from granite. Locally, however, others of the highly crystalline or metamorphic rocks have contributed to their formation. The difference in texture and in color of the surface soils of the Cecil sandy loam and the Cecil clay is probably due to incipient erosion. In the level areas or where the slope is very gentle, the agitation of the raindrops and the action of slow-flowing sheet water have removed the finer material from the surface, and left a preponderance of coarser sands, forming the sandy loam cover of the Cecil sandy loam type. On the steeper slopes or where the influence of the sheet water resulting from heavy rains has been sufficiently active to remove the coarser grains of sand with the finer material, usually no such marked separation has resulted, and the heavier members of the Cecil series have a red soil as well as a red subsoil.

The Cecil sandy loam is identified with that form of agriculture prevalent in the central portion of North Carolina, the western portion of South Carolina, northern Georgia, and central Alabama, where cotton is the dominant crop, with corn grown mainly for home use. Locally there is some production of peaches, watermelons, and truck crops, and in North Carolina of dark tobacco. The Cecil clay, extending from central Virginia southward, is one of the important cotton soils from North Carolina southward. In southern Virginia it is dominant in the production of the Virginia type of export tobacco leaf, and in North Carolina in the production of domestic manufacturing tobacco. It is a much more difficult soil to work than is the Cecil sandy loam, and its full value has not been developed with the light equipment of horses and implements that is generally used. Its true place is for the production of corn, small grains, and forage crops, tobacco, and for the fattening of cattle and dairying, as modified by the range of climatic conditions under which the soil occurs and by market and transportation facilities. It is an excellent soil for hay grasses rather than for pasture grasses.

The Chester soils are gray, with yellow subsoils. They occur from northern Virginia northward. They are derived typically from gneiss, although the more highly crystalline rocks and the less metamorphosed rocks have contributed locally to their formation. These soils are dominant in that type of agriculture which is characteristic of northern Virginia, central Maryland, and southeastern Pennsylvania, in which general farming is practiced, with corn, wheat, and both pasture and hay grasses as dominant factors, and with the feeding of cattle, the dairy interests, and, locally, the production of canning crops, particularly sweet corn and tomatoes, as other important industries.

The Penn soils are Indian-red in color, and have Indian-red subsoils. They occur in a rather narrow and discontinuous belt extending through the center of the Piedmont region from North Carolina northward. They are derived from the disintegration of Triassic sandstone and shale, but little, if at all, metamorphosed. They are associated with the same type of agriculture as prevails on the Chester soils and have about the same adaptation as the Hagerstown soils, but are not quite so productive as either of these series, and are more influenced by unfavorable climatic conditions in unusually wet or dry periods.

Glacial Lake and River Terrace Province.—The Glacial Lake and River Terrace Province covers an area in which the soil material has been derived from glacial material, reworked, carried by glacial rivers, and deposited as terraces, or, after having been delivered by the rivers and discharged into the glacial lakes, has been reworked by wave action and redistributed by the lake currents and then left in relatively depressed areas by the recession or disappearance of the lake.

Soils of this common origin occur generally bordering the Great Lakes, with narrow strips along some of the New York and New England rivers, along the Red River of the North, on the site of the old glacial lake Agassiz, and in numerous small areas throughout the glacial regions, where former glacial lakes existed but have entirely disappeared. Soil materials of this origin cover about 2.3 per cent of the area of the United States.

The Glacial Lake and River Terrace Province carries about 4.4 per cent of the rural population of the United States and 4.2 per cent of the farm operators, giving about 63 operators per 10,000 acres of total land area, with 56.6 per cent of the province classed as improved land in farms, which is about 5.1 per cent of the improved land in farms in the United States.

Three soils have been selected as the dominant soils of the province, the Clyde series, covering about 17 per cent, the Dunkirk series,

covering about 16 per cent, and the Fargo series, covering about 18 per cent of the province. The types selected to represent these series are dominant.

The Clyde soils are black, with drab subsoils. They occur east of Minnesota. In many places they are in need of drainage. They are dominant in the production of sugar beets, especially in Michigan and Wisconsin, in the production of cabbage and onions, and locally in the production of corn and hay grasses.

The Dunkirk soils are light brown, with yellow subsoils. Their greatest development is in New York State along the shores of Lake Erie and Lake Ontario. They have much better natural drainage than have the Clyde soils. These soils are dominant in the production of fruit, especially apples, in the production of table grapes, corn, and hay grasses, in the feeding of cattle, and in the dairy industry.

The Fargo soils are black, with drab to gray subsoils, the material usually being highly calcareous. They are confined to Minnesota, the Dakotas, and Iowa.

THE SOIL REGIONS OF THE UNITED STATES.

Great Plains Region.—The Great Plains is a vast outwash plain, and consists of heterogeneous material which was transported, segregated, and arranged under river and marine conditions, and later more or less consolidated into sandstone, shale, and limestone, and elevated above the level of the ocean.

Subsequently a large part of the surface has been covered by alluvial-fan material and river-borne material from the Rocky Mountains, and a considerable part by wind deposits of silt and sand. The Great Plains Region has an elevation of about 8,000 feet near the Rocky Mountains, and slopes gently eastward to an elevation of about 800 feet along the Mississippi River.

This region comprises western North Dakota, southeastern Montana, the western and greater portions of South Dakota, Nebraska, and Kansas, the eastern portions of Wyoming, Colorado, and New Mexico, and northwestern Texas, and extends a short distance into western Missouri. The region covers about 17.4 per cent of the total area of the United States.

The Great Plains Region carries about 8.7 per cent of the rural population of the United States, and 10.2 per cent of the farm operators, having about 19 operators per 10,000 acres of total land area. About 23.4 per cent of the region is improved land in farms, which amounts to about 16.3 per cent of the improved land in farms in the United States.

Six soils have been selected as the dominant soils of the Great Plains Region. The Crawford silt loam, the Oswego silt loam, the Morton fine sandy loam, and the Vernon silt loam represent residual soils weathered from the consolidated rocks. The Amarillo silty clay loam represents the alluvial-fan material, and the Colby silt loam the wind-laid material.

The Crawford soils cover about 5.1 per cent of the area thus far surveyed in this region, the Oswego soils about 1 per cent, the Morton soils about 9.6 per cent, the Vernon soils about 1.8 per cent, the Amarillo soils about 8.3 per cent, and the Colby soils about 12.1 per cent. The types selected are the dominant types of these series.

The Crawford soils have dark-brown to reddish-brown surface soils and reddish-brown to red subsoils. These are residual limestone soils of the prairie region. Limestone is frequently encountered 2 to 5 feet below the surface, but the soil itself contains only a small percentage of lime. These are important general-farming and fruit-growing soils of Iowa, Kansas, Missouri, and Texas.

The Oswego soils are gray to yellowish brown, with yellow to drab, stiff, impervious subsoils. They occupy level to gently rolling prairies. These soils are derived from shale. They are less productive than the Crawford soils, but are important in the production of general farm crops in Kansas, Missouri, and Oklahoma.

The Morton soils are brown, with light-brown or gray subsoils. They have a high lime content. The surface of these soils is undulating to rolling, and drainage is good. The Morton soils are derived mainly from fine-grained sandstones and shales. These are important wheat soils of the Dakotas and the eastern parts of Montana and Wyoming.

The Vernon soils have reddish-brown surface soils and light reddish brown, compact subsoils. They are derived mainly from the sandstones and shales of the Permian Red Beds, and contain large quantities of lime and gypsum. These are the productive red soils so extensively developed in Kansas, Oklahoma, and western Texas. They are peculiarly adapted to wheat, corn, cotton, and forage crops, particularly kafir, and to alfalfa where moisture conditions are favorable.

The Amarillo soils are brown to reddish brown, and are underlain by reddish-brown subsoils. They occupy the high plateau of Kansas, Oklahoma, and Texas, and are derived from unconsolidated alluvial-fan materials. They are the dominant kafir and small-grain soils of the region in which they occur.

The surface soils of the Colby series are gray to brownish gray, with brown silt loam subsoils. The topography varies from almost flat to rolling. These soils are derived by weathering from wind-

blown materials. They are important in the production of wheat, corn, and forage crops in northwestern Kansas and southwestern Nebraska, and in eastern Colorado. These are the dominant wheat soils of western Kansas.

Northwest Intermountain Region.—The Northwest Intermountain Region covers an area in which the soil material is mainly underlain by sheets or flows of basaltic rocks of comparatively recent date.

In the gravels of the region basaltic material is dominant. Owing, however, to a variety of dynamic agencies subsequently active in the formation and modification of the soil material, much of the original basaltic surface has been veneered with transported and unconsolidated material derived from a variety of rocks. In certain localities the underlying rocks have been faulted and uplifted or folded by movements of the earth's crust, and in other cases volcanic cones and masses rise above the general level. In such localities residual soils derived through weathering from the basaltic rock in place occur. They are usually shallow, stony, of rough topography, and nonirrigable. In other cases the soil material is composed largely of pumice or other fine fragmental material ejected from volcanic cones or craters now extinct.

Of the transported material, extensive areas of the desert plains, which make up most of the present surface, consist of old deposits of streams now extinct but once flowing in conspicuous valleys, by which their courses may be traced. They indicate a former period of less arid conditions than now prevail, and much of the waters and sediments were derived from melting glacial ice. In the northern part of the region extensive glacial outwash plains of this character occur. Other portions of the region were subject to deposition of light-colored sediments of fine sand, silt, and clay in the quiet waters of extensive lakes. The parent material was not confined to basaltic formations, but included a variety of rocks. In eastern Oregon and Washington and northern Idaho occur also extensive deposits of eolian or loessial material derived from a wide variety of rocks and consisting of fine unstratified homogeneous deposits which have probably filtered from a dust-laden atmosphere and have deeply buried the basaltic plains. In extensive areas of the Snake River and Columbia River plains another group of eolian deposits occurs. These are of coarser sandy texture, and have been wind blown rather than wind borne, being transported mainly by rolling and blowing of the mineral fragments along the surface.

These various stream-laid, lake-laid, and wind-laid deposits have in some cases been subject to weathering in place, with alteration in their mineral, chemical, and physical character, and with corresponding changes in color, texture, and structure, accompanied by leaching, concentration of lime or other minerals from percolating solutions,

and the formation of heavy subsoils and hardpans. In other cases they have been intrenched or dissected by later streams, eroded, reworked, and redeposited as recent stream flood-plain or terrace deposits or as alluvial-fan accumulations, often with an admixture of material derived from rocks foreign to the region.

The soils of this region, as developed under these various processes, occupy central and southeastern Washington, central and eastern Oregon, that portion of Idaho exclusive of the Rocky Mountain Region, and a small portion of northeastern California. They constitute about 4 per cent of the total area of the United States.

The region supports about 1 per cent of the rural population and 0.9 per cent of the farm operators of the United States, giving seven operators for 10,000 acres. About 12.4 per cent of the region is improved land in farms, which is equivalent to 2 per cent of the total improved farm lands in the United States.

Two soils have been selected as representative of this region in character and in type of agricultural development, the Walla Walla silt loam of the loessial material and the Yakima fine sandy loam of the recent alluvial flood-plain and terrace material. The Walla Walla soils cover about 9.3 per cent, and the Yakima soils about 6.9 per cent of the area surveyed in this region. The types selected are the predominating soils of these series.

The Walla Walla soils are of brown to dark-brown color, with slightly lighter or more reddish brown subsoils, and underlain by a substratum of light-brown or yellowish-brown fine silty material without stratification and of homogeneous character. This material, which may be somewhat calcareous, extends to the underlying bedrock, usually occurring at a depth of many feet. The soil material is derived from an undetermined though wide variety of rocks. The soils occupy a rolling to rather hilly region. They are not well adapted by conditions of climate or irrigation to fruit culture, but they are friable, retentive of moisture, and usually productive, and with related series of soils differing only in color are the great wheat-growing soils of the Palouse region in eastern Washington and Oregon and northern Idaho.

The Yakima soils are of light-brown to medium-brown color; the subsoils are usually friable, not heavier than the surface soil, and underlain by a porous sand and gravel substratum. These soils occur as recent alluvial deposits in stream valleys. The parent material is derived largely from basaltic material, but material derived by erosion from adjacent lake sediments or from more remote areas of rocks of various kinds may be included. These soils are usually favorably situated with regard to protection from frosts and means of irrigation, and have been highly developed in the production of

choice apples, pears, and other tree fruits, small fruits, cantaloupes, hops, and alfalfa.

Pacific Coast Region.—The Pacific Coast Region covers an area of consolidated rocks. Broadly, it is of mountainous character, with narrow to broad structural valleys or basins. The areas of consolidated rocks are characterized by residual soils derived from weathering of the underlying rock in place. The valleys and basins are partially filled with transported soil material derived from the residual soils of the adjacent mountains and deposited in different ways and under varied conditions. Isolated marginal areas of marine coastal plain sediments occur along the coast.

In California the Sierra Nevada on the east is made up mainly of metamorphosed sedimentary and igneous rocks with great intrusions of granite, such as constitute most of the related southern California ranges. The Coast Ranges of the region are mainly of softer sedimentary or of metamorphosed sedimentary rocks, with minor igneous intrusions. The Klamath Mountains of northern California and southern Oregon are related to the Sierra Nevada, and the Cascade Range, extending from northern California to the international boundary, is mainly of basaltic or andesitic volcanic origin. The transported soil material derived from these various sources has accumulated through agencies of deposition by melting glacial ice, by running water, in waters of inland seas, or as coastal beach and marine shore deposits which have since been elevated, and by winds. The deposits in the seas occupying the inland basins include both fresh and salt water sediments; the stream-laid deposits include glacial and nonglacial sediments and those distributed both as low, broad to steeply sloping alluvial fans and as flood-plain and river-terrace accumulations.

Much of this transported material has since deposition been weathered in place, with the development of more pronounced colors, leaching, concentration of lime, and the formation of heavy subsoils and hardpans. This older material is also now undergoing degradation or removal by erosion, and much has been reworked and redistributed as recent alluvial material by streams. Modification and redistribution of both the older and younger deposits by winds is also taking place locally.

The soils of this region cover portions of Washington, Oregon, and California lying west of the eastern base of the Cascades, the Sierra Nevada Mountains, and associated southern California mountain ranges marking the western boundary of the southwestern desert areas. They cover about 5.7 per cent of the total area of the United States.

The Pacific Coast Region supports about 2.7 per cent of the rural population of the United States, and 2.1 per cent of the farm opera-

tors, giving 12 operators per 10,000 acres. The 11.4 per cent of the region in improved farms is equivalent to 2.6 per cent of the improved farm lands of the United States.

Five soils have been selected as the most important of the region. Four of these, the Fresno sand, Placentia loam, San Joaquin sandy loam, and Stockton clay adobe, represent the weathered, older valley filling material, characterized by heavy subsoils or hardpans. The recent alluvial soils are represented by the Hanford fine sandy loam. These are the dominant types of their respective series. Of the area thus far surveyed in this region, the Fresno series comprises 6.02 per cent, the Placentia series 2.98 per cent, the San Joaquin series 5.66 per cent, the Stockton series 0.95 per cent, and the Hanford series 5 per cent.

The Fresno soils are brown to light brown in color, with variations of light grayish brown or light gray under dry field conditions. The subsoils are of similar or slightly lighter color, usually of heavier texture, except in the sandier members, are sometimes calcareous, and in the types of medium and heavy texture have a gray to light-brown hardpan. The series occupies old alluvial-fan deposits of flat to gently sloping and frequently of hummocky or irregular surface. The material is derived from a variety of rocks, has been weathered in place since deposition, and in case of the lighter members is sometimes modified by winds. The heavier soils usually are poorly drained, and injurious accumulations of alkali salts occur, but the lighter members are extensively irrigated and highly developed in the production of raisins, sweet wine and table grapes, peaches, apricots, watermelons, and alfalfa.

The Placentia soils and subsoils are red or brownish red in color under field conditions, the dry samples, however, usually appearing reddish brown. The subsoils are generally of more pronounced color and of heavy, compact character, but without true cemented hardpan. The material is low in humus, is not calcareous, is derived mainly from granitic rocks, and occurs mainly as old weathered, well-drained, and frequently eroded alluvial-fan deposits. Where capable of irrigation, the Placentia soils have in southern California become the principal orange and other other citrus fruit soils of the types derived from the older valley-filling material.

The San Joaquin soils, like the Placentia soils, are red or brownish red under moist field conditions, but air-dry samples are more nearly reddish brown. The subsoils are heavy and compact, with a cemented clay-iron hardpan which is impenetrable to subsoil waters and the roots of ordinary field and fruit crops. These soils occupy old valley plains, are frequently poorly drained, and are utilized mainly for the production of grains under dry-farming systems.

The Stockton soils are dark gray or black and high in organic matter, with black to dark-brown, heavy, compact upper subsoils which rest upon yellowish-brown, more friable, calcareous deeper subsoils containing calcareous nodules and discontinuous layers of calcareous hardpan. The material is derived from a wide variety of rocks. These soils occupy low, flat valley plains or lower extremities of alluvial fans of poorly developed drainage, and are predominantly of heavy texture and compact, adobelike structure. Owing to their physical character and position they are particularly well suited to the growing of rice under irrigation, and are otherwise utilized mainly for the production of other grains and for general farming.

The Hanford soils are brown, with brown, friable subsoils, not usually heavier in texture than the surface soils. They consist of recent alluvial-fan, river flood plain, and low recent stream deposits which have not been weathered sensibly since deposition. The material is derived mainly from granitic rocks and usually is noticeably micaceous. These soils are of extensive occurrence, usually favorably situated for irrigation, and are widely utilized for intensively cultivated citrus and deciduous fruits, grapes, small fruits, and truck crops. The growing of alfalfa and general farming are also important pursuits.

Rocky Mountain Region.—The Rocky Mountain Region covers an area in which the soil-forming material is derived by weathering in place of quartz-bearing crystalline rocks of igneous and metamorphic character, such as granite and gneiss, and of later effusive volcanic flows of basalt and other lavas, and of sedimentary and metamorphosed sedimentary rocks, including sandstone, shale, limestone, and quartzite. The original residual material has, in many portions of the region, been acted upon and modified by agencies of transportation and by further weathering in place.

The agencies of transportation consist of ice, wind, and water, giving rise to limited areas of ice-laid or glacial soils in the northern and in the higher mountain portions of the region, to areas of eolian soils occurring upon plains and in river valleys, and to large and important areas of water-laid soils occupying the greater part of the valleys. Some of this water-laid material has been deposited by intermittent or fluctuating streams, often torrential, emerging from mountain canyons, and now forms extensive alluvial fans. Some of it has been deposited as food-plain and river-terrace deposits, and some has been discharged into the waters of lakes and deposited and reassorted to some extent by waves and currents. Some of these sediments may have been of glacial origin, and much of the material has been weathered in place until it has lost to a certain extent its original character and has been eroded and entrenched by the streams

of younger valleys. Owing to predominant conditions of topography, depth of soil material, transportation, and of climate and irrigation, the agricultural soils of the region are limited mainly to the soils derived from the transported material.

The soils of this region cover northeastern Washington, northern Idaho, and western Montana, and extend southward across the Rocky Mountain Cordilleran and Plateau districts of eastern and southern Utah, western Colorado, and into southern Arizona and New Mexico. They thus cover a belt, from some 200 to 600 miles wide, extending nearly the whole width of the United States. They form 14 per cent of the total area of the country.

This region contains 1.8 per cent of the total rural population of the United States and 1.3 per cent of the farm operators, or 3 operators to 10,000 acres. Improved land in farms covers 2.6 per cent of the region and constitutes 1.4 per cent of the improved farming lands in the United States.

Two soils have been selected as the dominant soils of their series and the more important soils of the region—the Mesa loam of the older, weathered valley filling material and the Billings fine sandy loam of the recent alluvial deposits. The Mesa series comprises 4.01 per cent and the Billings series 3.19 per cent of the area surveyed in the Rocky Mountain Region.

The Mesa soils are of light pinkish-red or grayish-red to light brownish red color, with lighter gray or pinkish-gray, calcareous subsoils, which are usually heavier in texture and more compact than the surface material. The subsoil rests upon a gravelly, calcareous substratum, often partially cemented. The organic-matter content is low, but the soils are retentive of moisture. These soils are most typically and extensively developed in the filled and eroded valleys of western Colorado, occupying old valley terraces or "mesa lands" of smooth or gently sloping surface except about eroded margins. They usually require irrigation for successful development, but where irrigated have been extensively utilized for the production of apples and peaches and of alfalfa, sugar beets, and general farm crops. Their topographic position insures to a great extent freedom from poor drainage, alkali, and destructive frosts.

The Billings soils and subsoils are of light-gray or light grayish brown to brownish gray color. There is usually but little difference in the character of the soil and subsoil, but the subsoil rests upon a substratum of stratified stream-laid deposits of variable and alternating texture, which may closely approach the surface. Both surface soil and subsoil may be more or less calcareous. These soils consist of recent alluvial deposits derived predominantly from shales, sandstones, and impure limestones. They are of widespread occurrence in the valleys of the larger streams draining and travers-

ing the areas of sedimentary rocks. They occur in stream flood plains and on lower terraces and low, broad local alluvial fans. Unlike the Mesa series, they have not been sensibly weathered or oxidized in place, have not developed as much color, and have characteristically heavy subsoils. The heavier members are, however, often of compact structure and are frequently subject to poor drainage condition and the accumulation of alkali salts. Lower lying bodies are in many cases affected by overflow. Climatic and drainage conditions are less favorable to fruit culture than with the Mesa soils and the series is more extensively utilized for the production of alfalfa, stock raising, and the production of grains, sugar beets, and truck crops and vegetables, though fruit is grown to some extent.

Arid Southwest Region.—The Arid Southwest Region is predominantly a series of alluvial fans. It covers an area in which the soil material has been derived mainly from crystalline rocks of granitic or gneissic character, but in part also from more recent lava flows, mainly of andesite and rhyolite, and from sedimentary and metamorphosed sedimentary rocks.

This soil material has been transported mainly by intermittent or shifting fluctuating streams and by surface wash. The greater part has been distributed as sloping alluvial-fan deposits of streams of infrequent but torrential flow which debouch from mountain canyons upon the desert plains of structural valleys. From the upper sandy and gravelly margins of these débris slopes rise half buried outlying isolated mountain masses and hills covered with shallow and rocky, nonirrigable residual soils. The lower extremities of the fans or alluvial slopes occurring farther out in the valleys become flatter and comprise finer material.

The few large streams having their source under less arid conditions and traversing the region have given rise to areas of flood plain and terrace deposits which occur in the wide, shallow stream valleys, and some of the finer sediments borne by streams or by gradually extending surface wash have been deposited in the waters of lakes occupying the lower portions of the valley basins. Some of these alluvial-fan, river-laid, and lake-laid deposits have since been further modified and transported by winds. In some cases the soils are characterized by the rocks from which they originally came, and they may have a single source or a number of sources, while in others they have been so affected by processes of weathering in place subsequent to their deposition that they have lost more or less of their original lithological and physical characteristics. Owing to conditions of arid climate, transportation, and source of water supply for irrigation, the agriculture of the region is confined mainly to the older valley filling and recent alluvial soils of the principal stream valleys.

The soils of this region occupy southern Arizona and New Mexico and extend into western Texas and southeastern California, and cover an area some 175 miles in average width and extending approximately 800 miles in a northwesterly and southeasterly direction. They constitute 4.2 per cent of the area of the United States.

The region supports 0.5 per cent of the rural population of the United States and 0.3 per cent of the farm operators, or about 3 operators to 10,000 acres. Approximately 1.6 per cent of the region consists of improved farm land, which is about 0.3 per cent of the improved land in farms in the United States.

Two soils, the Imperial fine sandy loam, of the older deposits, and the Gila fine sandy loam, of the recent alluvial deposits, have been selected as representing the prevailing type of agriculture, and these are the dominating soils of their respective series. The Imperial series covers 30.85 per cent, and the Gila series 24.01 per cent of the area surveyed in this region.

The Imperial series includes light-brown soils and subsoils, usually of peculiar purplish tint, with heavy, compact, deeper subsoils, and substrata. The organic-matter content is low and the soils are sometimes subject to deficient drainage and the accumulation of alkali. They are derived from old lake sediments, the superficial surface material of which has, however, to a greater or less extent, been modified by later distribution by streams and winds. Under favorable conditions of irrigation they have in the Imperial Valley of California been highly developed and are extensively utilized for the production of cotton, cantaloupes, and alfalfa, and for general farming.

The Gila series includes light-brown soils and subsoils, frequently of pinkish or purplish tint and quite similar in color to the Imperial soils. The subsoils are variable in texture. They are underlain by or include porous sandy and gravelly material. Lower lying areas are subject to overflow and to poor drainage and alkali, but are usually capable of drainage and reclamation. These soils consist of recent alluvial deposits occurring mainly in stream valleys and bottoms. Where irrigable they are highly valued for the production of truck crops, alfalfa, and tree and small fruits, and for general farming. They are most extensive and important in the Gila, Salt, Rio Grande, and Colorado River Valleys.

Great Basin Region.—In the Great Basin Region the soil-forming material is dominated by deposits laid down in the waters of lakes which formerly covered the valley basins but have since receded or disappeared. The material has been derived from a variety of rocks, consisting mainly of basalt, rhyolite, diorite, and other volcanic effusives and intrusives, and of limestone and other sedimentaries and metamorphosed sedimentaries, and has been borne to the

lake basins in the waters of streams which at present have no other outlet. The coarser material was deposited about the margins of the lakes and later appeared as elevated gravelly terraces with the progressive evaporation of the waters, the finer material was swept farther out by currents and deposited as stratified beds of silt and clay in more remote and flatter portions of the basins, in some of which remnants of the earlier Quarternary lakes persist.

The larger areas of these deposits have been entrenched by streams, drained, and weathered in place, with accompanying modification through leaching and concentration of lime or other mnieral deposits, through oxidation and consequent changes in color, and through the formation of heavy subsoils or hardpans. About the margins of the present lakes occur recent unweathered sediments which retain their original character or may still be in process of deposition or of exposure by further recession of the lake waters.

In certain cases the lake-laid material has been eroded, reworked, and redeposited by the waters of streams, and other portions have been modified by winds. From the desert lake basins of the structural valleys making up most of the region rise ranges and isolated island-like mountain masses covered with thin, rocky, and usually non-irrigable residual soils derived by weathering of the underlying rock in place. The mountain bases frequently are partly buried beneath later shelving or sloping accumulations of disintegrated rock débris, swept from the mountain sides by intermittent torrential streams and distributed as extensive alluvial fans and débris aprons which extend into the valley basins and cover portions of the older lake deposits.

The Great Basin soil region practically coincides with the physiographic province of the same name. It occupies the western portion of Utah, practically all of Nevada, and adjoining portions of Oregon and California, and constitutes about 6.2 per cent of the area of the United States.

This region supports 0.3 per cent of the rural population of the United States, and 0.2 per cent of the farm operators, or approximately 1 operator to 10,000 acres, and 1.6 per cent of the region is in improved land, constituting 0.4 per cent of the improved farm lands of the United States.

Two soils have been selected as representative of the soils of the region—the Trenton loam and the Carson clay loam. These soils are the predominating types of their series. The Trenton series constitutes 5.2 per cent and the Carson series 1.4 per cent of the area surveyed in this region.

The Trenton series comprises brown to dark-brown soils, often with a somewhat reddish or pinkish hue under field conditions. The subsoils are of somewhat lighter brown or gray color, often of light-

reddish or pinkish tint, calcareous, and underlain by stratified, calcareous lake sediments of fine texture and of reddish-gray or light reddish-brown color, sometimes mottled. This series is derived from moderately old lake-laid deposits in which weathering and leaching have taken place to some extent, with concentration of lime, and usually the formation of heavy subsoils. Drainage is fair to somewhat deficient. The soils are not as well adapted to fruits as the soils of the adjacent higher lying areas of older material, but are excellent sugar-beet and general farming soils. They occur typically in the Cache Valley, Utah.

The Carson soils and subsoils are dark gray or drab in color, high in organic matter, and less highly calcareous than the Trenton soils. The heavy types predominate, and they are characterized by poor drainage and flat surfaces. These soils consist of the most recent lake sediments and occur about the margins of present lakes constituting remnants of earlier and more extensive bodies of water. They occur typically in the Carson and Honey Lake Valleys in Nevada and California. The Carson soils are less favorably situated with regard to frost than the older and more elevated soils, and are adapted to extensive rather than to intensive farming. They are utilized mainly for native hay, grazing, and stock raising on a large scale; and for general farming.

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